Vitamin D Administration, Cognitive Function, Blood Brain Barrier Permeability and Neuro-Inflammatory Factors in High-Fat Diet Induced Obese Rats

Ghazaleh Hajiluian1*, Mahdieh Abbasalizad Farhangi2, Ghazaleh Nameni2, Parviz Shahabi3, Mehran Mesgari-Abbasi4

1Department of Nutrition, School of Public Health, Iran University of Medical Sciences, Tehran, Iran
2Nutrition Research Center, Department of Community Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran
3Department of Physiology, School of Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran
4Drug Applied Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Abstract
Recently neuro-inflammation and cognitive impairment has attracted attention. It has been suggested that obesity leads to cognitive impairments induced by neuro-inflammatory markers like nuclear factor kappa B (NF-kB) and reduced neurotrophin factors like brain-derived neurotrophic factor (BDNF) in the hippocampus. Also, increased blood brain barrier (BBB) permeability. Because of the neuro-protective effects of vitamin D, we aimed to investigate the effects of vitamin D on cognitive function, NF-kB and BDNF concentrations in the hippocampus and BBB permeability high-fat diet induced obese rats. Forty male Wistar rats were fed either a control diet (CD) or high fat diet (HFD) for 16 weeks, then each group randomized in to two subgroups supplemented with vitamin D for 5 weeks. Morris Water Maze test was done at the 21st week to examine cognitive function, BBB permeability was characterized by measuring Evans blue dye in the hippocampus. Moreover, BDNF and NF- kB protein levels in the hippocampus. HFD significantly led to cognitive impairments, due to elevated NF-kB concentrations as neuroinflammatory factor (P=0.01) and reduction of BDNF (P=0.04) concentrations in the hippocampus. we showed that vitamin D supplementation in HFD group reduced body weight, NF- kB concentrations, BBB permeability (P=0.001 and P=0.03 respectively) and increased BDNF concentrations (P=0.002). Vitamin D reversed HFD induced cognitive impairments via reduction of the NF-kB, elevation in BDNF and modulation of BBB permeability in hippocampus, thus it can be considered as a beneficial therapeutic approach for prevention and treatment of neuroinflammation and cognitive deficits.

Keywords: Obese, Vitamin D, Blood Brain Barrier

*Corresponding Author: Ghazaleh Hajiluian
Email: LghazalehL@yahoo.com